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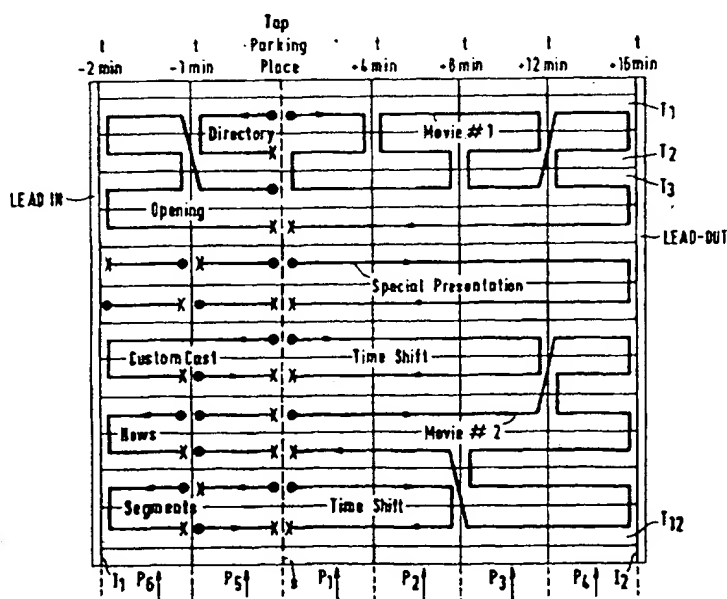
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(54) Title: INFORMATION RECORDING ON A MULTITRACK RECORD CARRIER



(57) Abstract

A recording apparatus and method for recording information in a multitrack record carrier with longitudinal tracks, where the total length of the record carrier has been divided into a plurality of sub portions, wherein the information has been recorded in a serpentine-like way.

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Information recording on a multitrack record carrier.

The invention relates to an apparatus for recording an information signal in a plurality of tracks running in the longitudinal direction of a longitudinal record carrier, such as a magnetic record carrier, to a record carrier and to a method of recording. An apparatus as defined in the foregoing is known from USP 4,318,141, document D1 in the list of related  
5 documents that can be found at the end of this description.

Conventional organisation of recording of information signals on a longitudinal record carriers is sequential, with information signals being recorded serially in one or more tracks along the length of the record carrier. Information signals are typically recorded in  
10 one or more tracks from the beginning of the record carrier to the end of the record carrier. If the information signal to be recorded is longer than the length of the record carrier, the transport mechanism steps the one or more heads to one or more different tracks and the recording process continues back from the end toward the beginning of the record carrier. Consequently, the multiple tracks are recorded in a serpentine like manner on the record  
15 carrier. The known apparatus has the disadvantage of a long access time for accessing the information recorded on the record carrier.

The invention aims at providing an improved apparatus for recording the information signal on a record carrier, which results in shorter access times for accessing the  
20 information.

The apparatus for recording an information signal in a plurality of tracks running in the longitudinal direction of a longitudinal record carrier, the apparatus comprising

- input means for receiving the information signal,
- 25 - signal processing means for processing the information signal so as to bring it in a form in which it can be recorded in the plurality of tracks on the record carrier,
- transport means for transporting the record carrier in either a first longitudinal direction or in a second longitudinal direction, which is reverse to the first direction,
- writing means for writing the processed information signal in said tracks on the record

carrier in a serpentine like manner, starting from a start location viewed in the first longitudinal direction of the record carrier towards a first end of the record carrier, the apparatus further comprising

- means for dividing the total length of the record carrier between said start location and said first end of the record carrier into a plurality of sub portions of the record carrier,
- the writing means being further adapted to write the processed information signal in a first track in a specific first portion, in the first direction from a first end to a second end of said first portion, the transporting means being further adapted to reverse the direction of transport into the second direction upon reaching the second end of said first portion, the writing means being further adapted to write the processed information signal in a second track in said first portion from said second end towards said first end, the transporting means being further adapted to reverse the direction of transport into the first direction upon reaching the first end, the writing means being further adapted to write the processed information signal in a third track in the first portion from said first end towards said second end of said first portion.

The invention is based on the following recognition. By dividing the total length between the start location and said first end of the record carrier into a plurality of sub portions, it is possible to make 'shorter' serpentes by reversing the transport direction of the record carrier upon reaching each end of a portion and switching over to another track. When a film is recorded in this way, it is possible to easily and quickly access other moments in time in the film by simply changing tracks.

These and other objects of the invention will become apparent from and further elucidated with reference to the embodiments described in the following figure description, in which

figure 1 shows schematically the record carrier,

figure 2 shows an apparatus in accordance with the invention,

figure 3 shows the record carrier obtained with the apparatus of figure 2 in more detail, and

figure 4 a schematic picture of a TV screen for priority setting.

Figure 1 shows the record carrier 2, schematically over its total length. The start end of the record carrier 2 is indicated by BOT (beginning-of-tape) and the final end is

indicated by EOT (end-of-tape). A lead-in portion and a lead-out portion are shown, being the portions between the start end (BOT) of the record carrier and the line  $l_1$  and the final end (EOT) of the record carrier and the line  $l_2$  respectively. A data area for recording the information signal is available between the lead-in portion and the lead-out portion of the record carrier 2.

Tracking signals may be recorded in the record carrier in order to enable recording of the information so as to obtain information tracks  $T_1$  to  $T_n$ , as shown in figure 1. Reference is made to the documents D2 to D6 which further describe the tracking signals and the use of such tracking signal. Where necessary, those documents are assumed to be incorporated by reference in the present application.

Figure 2 shows an embodiment of an apparatus for recording an information signal on the record carrier 2 of figure 1, which has tracking signals prerecorded on it. Figure 3 shows how the information signal is recorded on the record carrier 2. The apparatus of figure 2 has an input terminal 30 for receiving the information signal. The input terminal is coupled to an input of a formatter unit 32, which converts the information signal into a format suitable for recording on the record carrier 2. An output of the formatter unit 32 is coupled to a write unit 33 comprising a write/read head 34. The formatted information signal is supplied to the write/read head 34 and recorded in one of the tracks  $T_1, T_2, \dots, T_n$  on the record carrier 1. The record carrier as shown in figure 2 is supposed to be transported in directions indicated by the arrow 31.

The head 34 is further adapted to read tracking signals recorded in the record carrier. The tracking signals are supplied to a filter unit 36, which has a bandpass filter characteristic with a centre frequency equal to the specific frequency of the tracking signals. As the frequency of the tracking signals is low relative to the frequency content of the formatted information signal, it is possible to read the tracking signals from the record carrier, while writing the formatted information signal into the track  $T_1$ .

A generator unit 38 is present for generating a control signal in response to the tracking signals read by the head 34. This control signal is supplied to an input 50 of an actuator unit 40. The actuator unit 40 actuates a movable mounting 42 on which the head 34 is mounted. The movable mounting can have any form. One preferred embodiment of a mounting is described in EP patent application no. 95202926.2, document D2 of the list of related documents, filed recently in the name of applicant, but not yet published. Further, the functioning of the tracking servo mechanism is extensively described in document D6 of the list of related documents.

A control unit 42 is present for controlling a motor transport unit 44. By controlling the motor transport unit, the record carrier 2 is transported in one of the two directions shown by the arrow 31.

Figure 3 shows an example of the record carrier after having recorded an information signal, such as a movie on the record carrier 2. The width of the record carrier is largely exaggerated in order to better explain the record carrier and the functioning of the apparatus. In total twelve tracks  $T_1$  to  $T_{12}$  are shown in this example.

As can be seen, the total length of the record carrier between the start point, which is the line  $s$ , and the end of the record carrier, which is the line  $l_2$ , is divided into a number of portions, denoted  $P_1$  to  $P_4$ . The portions are in this example of equal length, which is expressed in time, as being of a length of 4 minutes of recording or reproduction time.

When recording a movie on the record carrier, indicated by movie #1, recording starts in track  $T_1$  indicated by the dot, at the start location indicated by the line  $s$ . As can be seen, in this example, the start location is not at the beginning of the record carrier but distance away from the beginning of the record carrier. Expressed in recording or reproduction time, the start position is located two minutes away from the beginning of the record carrier, which is the line  $l_1$ . During recording the first four minutes of the movie, in this example, the record carrier is transported in such direction that recording takes place in the track  $T_1$ , in the direction towards the end  $l_2$  of the record carrier. Thus, a portion of the information signal is recorded in that part of the track  $T_1$  lying in the first portion  $P_1$ . After four minutes have lapsed, the transport direction of the record carrier is reversed. Further, the head is positioned so that recording continues in track  $T_2$  in a direction towards the start position, that is the line  $s$ . Thus, a portion of the information signal is recorded in that part of the track  $T_2$  lying in the first portion  $P_1$ . Upon reaching the start position, the transport direction of the record carrier is again reversed. Further, the head is replaced so that recording continues in the track  $T_3$  in a direction towards the end, the line  $l_2$ , of the record carrier. Recording continues for the next 8 minutes, until the transport direction of the record carrier is again reversed. Thus, a portion of the information signal is recorded in that part of the track  $T_3$  lying in the portions  $P_1$  and  $P_2$ . The head is positioned in cooperation with the track  $T_2$  and recording continues for 4 minutes, until the head reaches the boundary line between the portions  $P_1$  and  $P_2$ . Next, upon reaching the said boundary line, the head is positioned above the track  $T_1$  and the transport direction of the record carrier is reversed. The next portion of the information is thus recorded in that part of the track  $T_1$  located in the

portion  $P_2$ . Recording continues in that part of the track  $T_1$  located in the portion  $P_3$ . Next, upon reaching the boundary line between the portions  $P_3$  and  $P_4$ , the head is positioned above the track  $T_2$  and the transport direction of the record carrier is reversed again.

Recording continues in the track  $T_2$ , until the boundary between the portions  $P_2$  and  $P_3$  is reached. The head is positioned above the track  $T_3$  and the transport direction is reversed. After having reached the boundary between the portions  $P_3$  and  $P_4$ , the head is positioned above the track  $T_1$  so that the final part of the track  $T_1$  can be filled with recorded information. Upon reaching the end of the record carrier, which is the boundary line  $l_2$ , separating the information area from the lead out area, the head is positioned above the track  $T_2$  and the direction of transport is reversed, so that the final part of the track  $T_2$  can be filled with information. Upon reaching the boundary between the portions  $P_3$  and  $P_4$ , the head is positioned above the track  $T_3$  and the direction of transport of the record carrier reversed so that the final part of the track  $T_3$  can be filled with information.

Upon again reaching the end of the record carrier, the head is positioned above the track  $T_4$  and the direction of transport reversed so that the information can be recorded in the track  $T_4$ . In the present example, the movie is 64 minutes long, so that the remaining part of the movie can be recorded in the track  $T_4$ , until the head has reached the starting position  $s$ .

Upon programming a movie for recording in the apparatus, the length of the movie is inputted in any form into the apparatus. Using this information, the apparatus is capable of choosing such a recording path through the various portions that the start and the end of the recording are at the same position viewed in the length direction of the record carrier, namely the position indicated by the line  $s$ .

In another embodiment, the information signal itself comprises information about the length of the movie. The apparatus is now capable of retrieving this length information from the information signal received, so that the apparatus is again capable of choosing the appropriate recording path through the various portions.

Other programs may not require the specific recording method as described above for movie # 1. As an example, another program, denoted 'special presentation' is recorded in the well known way in the tracks  $T_5$  and  $T_6$  and again another program, denoted 'time shift' is recorded in the portions  $P_1$ ,  $P_2$  and  $P_3$  of the tracks  $T_7$  and  $T_8$  and another program, also denoted 'time shift' is recorded in the portions  $P_1$  and  $P_2$  of the tracks  $T_{11}$  and  $T_{12}$ .

The program denoted 'movie # 2' is also characterized by the specific recording

method as described above. The method is advantageously used in order to fill the empty portions in the tracks  $T_7$ ,  $T_8$ ,  $T_{11}$  and  $T_{12}$  behind the programs denoted 'time shift'.

As has been said earlier, the start location, indicated by the line  $s$ , is not at the beginning of the record carrier, but at a distance therefrom. This enables the recording of  
5 further programs in the area between the beginning of the record carrier, indicated by the line  $l_1$ , and the start location, indicated by the line  $s$ . Those recordings can also start at the start location. The part of the record carrier between the beginning  $l_1$  and the start location  $s$  of the record carrier is also divided into a number of, in this example two, portions  $P_5$  and  $P_6$  of one minute of recording-reproduction time each. As can be seen in figure 3, a  
10 directory (table-of-contents) is recorded in the parts of the tracks  $T_1$  and  $T_2$  inside the portion  $P_5$ . The directory starts at the start location  $s$  and can be read by scanning the track  $T_1$  in the second direction, that is from right to left in figure 3. Upon reaching the boundary between the portions  $P_5$  and  $P_6$ , the direction of transport of the record carrier is reversed and the head is positioned above the track  $T_2$ , so that the remaining part of the direction recorded in  
15 the track  $T_2$  and within the portion  $P_5$  can be read. Positioning the directory in the way as shown has the advantage that, after having recorded a movie, such as the movie#1, the directory can be updated very quickly. After having terminated the recording of the movie#1, the head is positioned on track  $T_4$ , at the start position line  $s$ . Updating the directory can be realized by repositioning the head in the vertical direction as seen in figure 3 towards a  
20 position where the head is positioned above the track  $T_1$ , so that the directory can quickly be updated, whilst after terminating the update, the head is again at the start location, line  $s$ .

The remaining part of the record carrier at the left hand side of the line  $s$  can be used for recording news items, as shown in the tracks  $T_9$  and  $T_{10}$ .

The apparatus could further be used in combination with a service provider for  
25 supplying services on demand of a customer. This is called 'custom-cast'. A custom-cast service provider may be capable of transmitting a so-called 'custom cast' message to the user. This message is received via some transmission chain and recorded automatically on the record carrier, as shown in figure 3 by the two items denoted 'customs cast' in the tracks  $T_7$  and  $T_8$  in the portions  $P_5$  and  $P_6$ . The user may switch the apparatus into a reproduction  
30 mode for a reproduction of the 'custom cast' information recorded. This could lead to a screen as shown in figure 4. This screen shows all subjects of information that can be chosen by the user. Upon choosing a subject and a corresponding priority, the priorities will be retransmitted to the service provider, which will transmit at a later moment information regarding the items chosen. Those items can be recorded automatically on the record carrier,



such as the items in the tracks  $T_{11}$  and  $T_{12}$  denoted 'segments', for a later retrieval.

More specifically, the items are recorded such on the record carrier that items having the highest priority are recorded first, and items having a lower priority are recorded 'later', in the sense that upon starting the reproduction mode by the user for those items, the  
5 items having the highest priority are reproduced first and the items having a lower priority are reproduced later.

The service provider is also capable of transmitting general information as regards programs and movies that can be obtained from the service provider. Such general information is recorded automatically on the record carrier, denoted by 'opening', in the  
10 tracks  $T_3$  and  $T_4$  in the portion  $P_5$  and the tracks  $T_1$  to  $T_4$  in the portion  $P_6$ . Further, commercials specifically related to the chosen priorities can be supplied by the service provider and recorded in the tracks  $T_6$  and  $T_7$ , in the portions  $P_5$  and  $P_6$ .

Whilst the invention has been described with reference to preferred embodiments thereof, it is to be understood that these are not limitative examples. Thus, various  
15 modifications may become apparent to those skilled in the art, without departing from the scope of the invention, as defined by the claims. As an example, the invention has been described with reference to a recording of an information signal by one head in one track on a record carrier. It should however be noted that the invention is equally well applicable to apparatuses in which the information is recorded using a plurality of heads in a plurality of  
20 tracks. The apparatus described is very well suitable in multi-media applications, as it enables an automated cooperation with a service provider's network.

Further, the invention lies in each and every novel feature and combination of features.

## Related documents

- (D1) USP 4,318,141
- 5 (D2) EP pat. appln. no. 95202926.2 (PHN 15.520), filing date 30.10.95
- (D3) EP pat. appln. no. 95203028.6 (PHN 15.543), filing date 08.11.95
- (D4) EP pat. appln. no. 95203029.4 (PHN 15.545), filing date 08.11.95
- (D5) EP pat. appln. no. 95203192.0 (PHN 15.563), filing date 21.11.95
- (D6) EP pat. appln. no. 95203380.1 (PHN 15.594), filing date 07.12.95

CLAIMS

1. Apparatus for recording an information signal in a plurality of tracks running in the longitudinal direction of a longitudinal record carrier, the apparatus comprising
- input means for receiving the information signal,
  - signal processing means for processing the information signal so as to bring it in a form in
- 5 which it can be recorded in the plurality of tracks on the record carrier,
- transport means for transporting the record carrier in either a first longitudinal direction or in a second longitudinal direction, which is reverse to the first direction,
  - writing means for writing the processed information signal in said tracks on the record carrier in a serpentine like manner, starting from a start location viewed in the first
- 10 longitudinal direction of the record carrier towards a first end of the record carrier, the apparatus further comprising
- means for dividing the total length of the record carrier between said start location and said first end of the record carrier into a plurality of sub portions of the record carrier,
  - the writing means being further adapted to write the processed information signal in a first
- 15 track in a specific first portion, in the first direction from a first end to a second end of said first portion, the transporting means being further adapted to reverse the direction of transport into the second direction upon reaching the second end of said first portion, the writing means being further adapted to write the processed information signal in a second track in said first portion from said second end towards said first end, the transporting means
- 20 being further adapted to reverse the direction of transport into the first direction upon reaching the first end, the writing means being further adapted to write the processed information signal in a third track in the first portion from said first end towards said second end of said first portion.
2. Apparatus as claimed in claim 1, the transporting means being further adapted
- 25 to reverse the direction of transport into the second direction upon reaching the second end of said first portion, the writing means being further adapted to write the processed information signal in a fourth track in the first portion from said second end towards said first end, the transporting means being further adapted to reverse the direction of transport into the first direction upon reaching the first end, the writing means being further adapted to write

the processed information signal in a fifth track in the first portion from said first end towards said second end of said first portion.

3. Apparatus as claimed in claim 1, the writing means being further adapted to write the processed information signal in a second portion directly following the first portion.

5 in one of said first, second and third tracks, from the first end towards the second end of said second portion, the transporting means being further adapted to reverse the direction of transport into the second direction upon reaching the second end of said second portion, the writing means being further adapted to write the processed information signal in a second one of said first, second and third tracks in the second portion from said second end towards  
10 said first end of said second portion, the transporting means being further adapted to reverse the direction of transport into the first direction upon reaching the first end of the second portion, the writing means being further adapted to write the processed information signal in a third one of said first, second and third tracks in the second portion from said first end towards said second end of said second portion.

15 4. Apparatus as claimed in claim 3, wherein the first one of said first, second and third tracks is the third track, the second one of said first, second and third tracks is the second track and the third one of said first, second and third tracks is the first track.

5. Apparatus as claimed in claim 1, wherein the start location does not coincide with the second end of the record carrier.

20 6. Apparatus as claimed in claim 5, further being adapted to record another information signal in tracks starting from said start location in said second direction towards the second end of said record carrier.

7. Apparatus as claimed in claim 6, wherein the means for dividing is further adapted to divide the total length of the record carrier between said start location and said  
25 second end of the record carrier into a plurality of sub portions of the record carrier, the writing means being further adapted to write the processed other information signal in the second direction in a third portion lying on the other side of the start location than the first portion, in a seventh track from a first end towards a second end of the third portion, the transporting means being further adapted to reverse the direction of transport into the  
30 first direction upon reaching the second end of said third portion, the writing means being further adapted to write the processed other information signal in an eighth track in the third portion from said second end towards said first end, the transporting means being further adapted to reverse the direction of transport into the second direction upon reaching the first end, the writing means being further adapted to write the processed other information signal

in a ninth track in the third portion from said first end towards said second end of said third portion.

8. Apparatus as claimed in claim 7, wherein the seventh track is the first track, the eighth track is the second track and the ninth track is the third track.

5 9. Record carrier obtained with the apparatus as claimed in anyone of the preceding claims.

10. Method of for recording an information signal in a plurality of tracks running in the longitudinal direction of a longitudinal record carrier, the method comprising the steps

- receiving the information signal,

10 - processing the information signal so as to bring it in a form in which it can be recorded in the plurality of tracks on the record carrier,

- transporting the record carrier in either a first longitudinal direction or in a second longitudinal direction, which is reverse to the first direction.

- writing the processed information signal in said tracks on the record carrier in a serpentine

15 like manner, starting from a start location viewed in the first longitudinal direction of the record carrier towards a first end of the record carrier, the apparatus further comprising the step of

- dividing the total length of the record carrier between said start location and said first end of the record carrier into a plurality of sub portions of the record carrier,

20 - the writing step and transporting step being further characterized by writing the processed information signal in a first track in a specific first portion, in the first direction from a first end to a second end of said first portion, reversing the direction of transport into the second direction upon reaching the second end of said first portion, writing the processed information signal in a second track in said first portion from said second end towards said first end,

25 reversing the direction of transport into the first direction upon reaching the first end, writing the processed information signal in a third track in the first portion from said first end towards said second end of said first portion.

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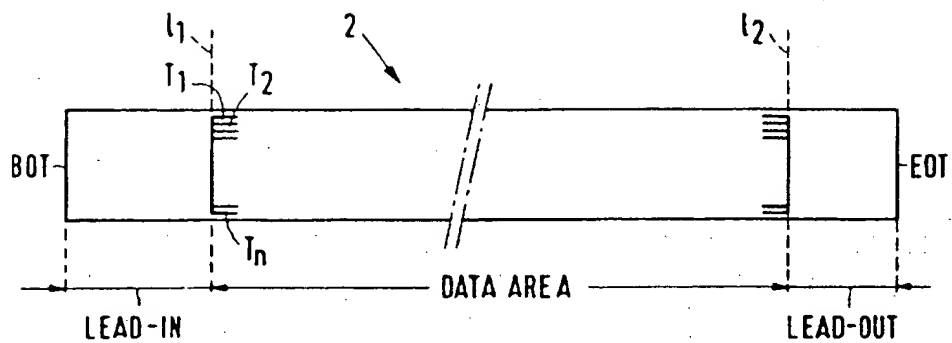


FIG.1

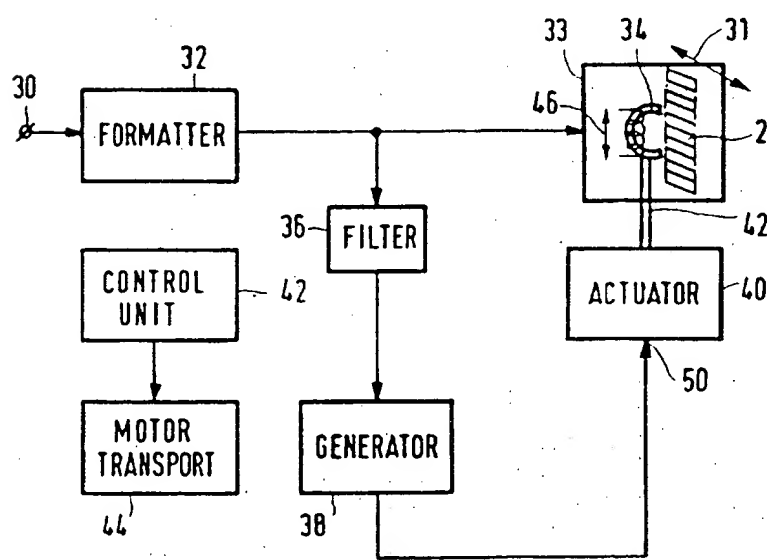


FIG.2

2/3

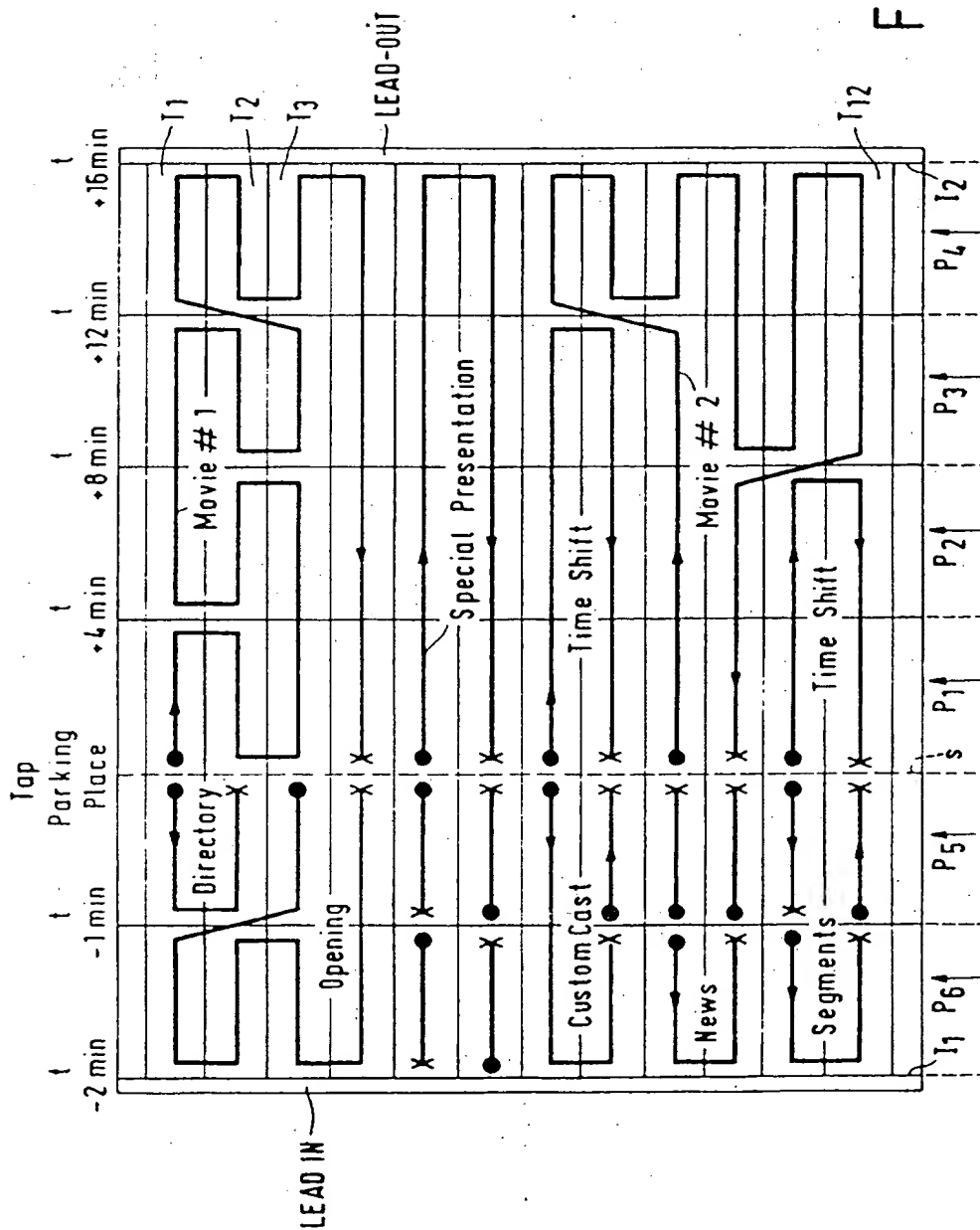


FIG.3

3/3

"CustomCast" User Defined Newscast - Profile for: G. Pine - Airtime: 19:00



FIG. 4

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 97/00682

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
IPC6: G11B 5/008 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: G11B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EDOC, WPI, JAPIO		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4558380 A (C.D. PORTER), 10 December 1985 (10.12.85), column 4, line 27 - line 42, figure 4b --	1,10
A	US 4422111 A (G.D. MOELLER ET AL), 20 December 1983 (20.12.83), column 4, line 57 - column 5, line 68, figures 1,2 -----	1,10
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
1 October 1997		02-10-1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer  Bo Gustavsson Telephone No. +46 8 782 25 00

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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